EXTENSION REPORT		
	Project Title: Corn Agronomy Project	
	Date: December 3, 2015	
	Project Start Date: **April 1, 2014**	**Project End Date:** **March 31, 2018**
	Principal Researcher: Dr. Yvonne Lawley	
	Position: Assistant Professor, Department of Plant Science, University of Manitoba	
	Address: 222 Agriculture Building, University of Manitoba, Winnipeg, MB R3T 2N2	
	Email: **yvonne_lawley@umanitoba.ca**	**Phone:** **204-474-6504**

Project Activities (April 1 to September 31, 2015):

The 2015 growing season was a productive period for the Corn Agronomy Project. With graduate students and new research equipment in place, we established new experiments and collected data from a wide range of field trials in 2015.

<u>Project Area 1: Crop Rotation</u>

Objective 1, 2, and 4: Identify the best crops to grow prior to corn in the rotation and evaluate fertilization strategies for corn grown after canola

Part A: Crop sequences before corn (Dr. Yvonne Lawley)

This portion of the project looks at the effects of preceding crop on corn growth and yield. In 2015, both phases of this experiment were grown. Corn test crops were grown on the treatment crop residues from the 2014 crop year. Treatment crops of wheat, canola, soybean, and corn were also established in 2015 for the 2016 corn test crop. Experiment sites for 2015 corn test crops included Carman and St. Adolphe. However, the plots at St. Adolphe were abandoned due to problems with weed control and a seeding error that resulted in wheat from the surrounding commercial field being planted in some plots. Measurements during the growing season included plant stand, plant height and stem diameter, silking date, and number of cobs per plant. Plant biomass samples were collected for P analysis and root samples were collected at six leaf and silking stage for analysis of arbuscular mycorrhizal colonization. Relative maturity rating and cob moisture readings were taken over a three week period in September. Grain yield and total above-ground biomass were recorded at harvest. A post-doctoral fellow, Dr. Navneet Brar, is working on this experiment.

Part B: Fertilization strategies for corn grown after canola (Dr. Don Flaten)

This portion of the project measures corn response to phosphorus and zinc fertilizer when corn is grown after canola vs. soybeans. Research in B.C., central Canada and elsewhere has shown that arbuscular mycorrhizal fungi (AMF) associations with corn play a key role in the ability of corn to acquire sufficient phosphorus and zinc. Therefore, to compensate for the deterioration in soil mycorrhizal populations after canola, corn growers in Manitoba may need to apply more P and Zn fertilizer when their corn crop follows canola, compared to following other crops, such as soybeans. An MSc. student, Magda Rogalsky, is working on this project.

In 2014, canola and soybeans were planted in replicated blocks at three locations, including one site in Carman (U of M Research Station), one site in a commercial field near Stephenfield and a third site near St. Adolphe. In 2015, corn test crops (DKC 26-28 corn hybrid) were planted into the crop rotation experiments at all sites. For Carman and Stephenfield, spring sidebanded (2” by 2” below and beside the seed row) fertilizer treatments (0, 30, 60 kg P_2O_5 /ha as MAP and MESZn) were applied at the time of planting into blocks that were previously cropped to canola or soybeans. Early season biomass was collected at V4 to determine P and Zn uptake and plant roots were collected to determine percent of root area colonized by AMF. Midseason plant height and NDVI were also measured. Maturity ratings were conducted for days to 50% pollen shed and silking date. Moisture measurements were taken on a weekly basis starting at milk (R3) and continuing until harvest to determine effects of sidebanded P on drydown. The corn test crop was harvested at $<25\%$ moisture; both moisture and grain yield data were collected and analyzed. Soil moisture samples were collected at the beginning and at the end of the season to assess if moisture was a yield limiting factor for each site. At the St. Adolphe site, quarantine regulations imposed by CFIA limited soil sampling and most field activities. The corn fertilization trial at this location had a reduced number of treatments (0, 30, 60 kg P_2O_5 /ha sidebanded as MESZn). Although the number of treatments was limited at St. Adolphe, the available corn planting equipment allowed for a total of 16 replicates of these treatments to be planted and harvested. Two additional sites were established this year (2015) with soybeans and canola as preceding crops for a corn test crop to be grown in 2016 at Carman, MB and Portage la Prairie, MB.

Objective 3: Economic Analysis of optimal crop rotations involving corn (Dr. Derek Brewin)

A graduate student, Hazel Sakulanda, has drafted a working model of a profit maximizing rotation tool based on recent yield impact data for Manitoba from MASC. Hazel presented her theory, methods and a first run of results in Newport, RI at the joint Annual meeting of the Canadian Agricultural Economics Society and the Northeastern Agricultural and Resource Economics Association in June of 2015. Her findings suggested a wheat/canola rotation was a dominant rotation under many conditions unless average Manitoba corn yields improve significantly relative to wheat and canola. Hazel's proposal and thesis should be defended in the winter of 2015/2016.

Project Area 2: Residue Management

Objective 4: Identify optimum corn residue management strategies (Dr. Yvonne Lawley)

On-farm corn residue management trials were set up in fall of 2014 near Winkler, MB and in spring of 2015 near MacGregor, MB. The trials included four corn residue management treatments using three field scale pieces of tillage equipment (tandem double disc, vertical till low disturbance, vertical till high disturbance, and strip till). A soybean test crop was planted into the corn residue management treatments in the spring of 2015. Prior to seeding, soil properties and corn residue coverage was determined. After soybean seeding, both sites were rolled. During the soybean growing season soil moisture, soil temperature, air temperature and precipitation were monitored on an hourly basis. Soybean emergence, flowering and maturing notes were taken three times a week during these critical growth stages. During the soybean flowering stage, NDVI pictures were taken by a UAV. Before soybean harvest, plant height and lowest pod height were measured. At harvest, a field length strip was harvested from each plot with a commercial combine and weighed with a calibrated weigh wagon. Grain samples were taken from every plot to measure grain moisture. An MSc student, Patrick Walther, is working on this project.

In October and November of 2015 a related experiment was conducted in collaboration with Prairie Agriculture Machinery Institute (PAMI). Pull force, horsepower requirement and fuel consumption of four different tillage implements (tandem double disc, strip till, and two contrasting vertical till units) were measured in two fields with contrasting soil types (sandy vs. clay) at two sites near MacGregor, MB.

Objective 5: Corn Fertilization and Residue Management (Dr. Don Flaten)

This portion of the project measures corn response to phosphorus management practices in strip tillage vs. conventional tillage systems. Most crops in the Prairies show substantial improvement in early season vigour, maturity and yield for placing P fertilizer in or near the seed row, especially when root growth and soil P availability is poor due to cold soils. However, most corn planters lack the capacity for placing P with or near the seed. Therefore, this project is comparing fertilizer side-banding at planting to precision pre-plant banding P during strip tillage in the fall. An MSc student, Magda Rogalsky, is working on this project.

In 2015, corn test crops (DKC 26-28 corn hybrid) were planted into the tillage experiments at two study site locations established in 2014, including one in Carman, MB and one at Portage la Prairie (Canada Manitoba Crop Diversification Centre). The fall 2014 tillage treatments included strip tillage and conventional tillage. For half of the plots in each tillage block, fall deep band fertilizer treatments (0, 30, 60 kg P_2O_5 /ha) were applied as MAP in fall, at time of tillage. Equivalent rates of sidebanded fertilizer were applied to the other half of the plots in each tillage block in spring 2015, at planting. Early season biomass was collected at V4 to determine P uptake. Midseason plant height and NDVI readings were taken. Maturity ratings were conducted for days to 50% pollen shed and silking date. Moisture measurements were taken on a weekly basis starting at milk (R3) and continuing until harvest to determine effects of sidebanded P on drydown. The corn test crop was harvested at <25% moisture; both moisture and grain yield data were collected and analyzed. Soil moisture samples were collected at the beginning and at the end of the season to assess if moisture was a yield limiting factor for each site. Two additional sites were established this fall (2015) with fall tillage treatments for a corn test crop to be grown in 2016 at Carman, MB and Portage, MB.

Project Area 3: Corn Heat Unit Evaluation

Objective 6: Evaluation of corn heat unit system for Manitoba (Dr. Paul Bullock)

In 2015, 8 study site locations (6 in Manitoba, 2 in Alberta) were seeded alongside corn yield trials overseen by Dr. Lana Reid, AAFC. One Manitoba site (Melita) did not emerge due to damage by geese after seeding. The 3 corn hybrids in the study were grown successfully to physiological maturity at all other sites except Roblin, where the longest season hybrid did not reach the 30% moisture content threshold by the end of October. Multiple daily images were collected for all hybrids at all sites along with daily and hourly weather data from stations on site. The images were used to determine the date on which the corn plants reached 50% emergence, 50% 4-leaf, 50% 6-leaf, 50% 8-leaf, 50% - tasseling and 50% - silking. Moisture measurements were used to determine physiological maturity. Initial analysis shows that the number of calendar days from seeding to PM varied from 3 to 4 weeks among the sites for each individual hybrid. The accumulated CHU from seeding varied by 400 to 500 CHU units among the sites for each individual hybrid. There may be an effect of moisture availability on the rate of phenological development, specifically the rate of development through the vegetative stage appears to be more rapid with optimal soil moisture availability (i.e. the 2 irrigated sites in Alberta). Conversely, vegetative stage development was slower in Roblin which had dry conditions early in the growing season. However, Roblin is also the northernmost site and slower development may also be related to cold overnight temperatures. An MSc student, Justice Zhanda, is working on this project.

Project Area 4: Corn Row Spacing

Objective 7: Evaluate corn row spacing to optimize corn yield and fall dry down (Dr. Yvonne Lawley)

A corn row spacing experiment was established the University of Manitoba Research Farm near Carman, MB. Four row spacing treatments (15 inch, 22 inch, 32 inch and 60 inch) were planted using a new precision planter with variable row spacing. Two corn hybrids, DKC27-55 and DKC 30-07, were compared. Previous experiments indicated that one variety was yield responsive to within-row population while the other was not. To keep the size of this experiment manageable in the first year, within-row spacing between corn plants was kept fixed at 6.5 inches between plants, but overall population varied between row spacing treatments. The experiment was planted on May 21, 2015. Measurements during the growing season included plant stand, plant height, corn stem diameter, and cob number per plant. Corn cob moisture readings were measured using non-destructive moisture meter on weekly basis for 10 consecutive weeks after silking and at harvest. Measurement collected at harvested included total above-ground biomass, grain yield, grain moisture, cob length, and number of kernels per cob.